REMARKS

This is in response to the Official Action dated November 6, 2002 in which claims 1-20 were rejected under Section 112, claims 1-3 and 14-20 were rejected under Section 103, and the subject matter of claims 4-14 was found allowable.

All of the claims were rejected as indefinite for various reasons. The claims have been amended solely to address the clarity concerns of the Examiner. Thus, Examiner's comment that the claims do not describe a process of forming a coating, only of removing layers of a coating, is addressed by adding the step of forming a multi-layer coating; the Examiner's comment that antecedent basis for the temperature is confused is addressed by making it clear that the step of removing layers of fullerene molecules is performed while maintaining the temperature of the substrate as described. In claim 18, "fullerene" before "solvent" has been deleted to avoid any interpretation that the solvent contains fullerene, and the "dissolve the fullerene" has been changed to "remove the fullerene molecules" to avoid any interpretation that the solvent breaks the molecular structure; instead, the solvent is of a type that breaks down the fullerene-to-fullerene bond. Conforming amendments are made throughout. The Examiner is invited to telephone the undersigned with a view to resolving any remaining issues.

Claims 1-3, 14, 15 and 17-19 have been rejected as anticipated by, or unpatentable as obvious over, the IBM Technical Bulletin "Molecular Brush Assembly", and claim 20 was rejected as unpatentable over the IBM Technical Bulletin in view of Bunshah (5,316,636).

The IBM Technical Disclosure Bulletin is directed to a technique of patterning an image in a fullerene layer on a metal or semi-conductor substrate. The process begins with a monolayer of fullerene molecules. The substrate containing the monolayer

is immersed in a solution containing "self-assembling" molecules 5 which bond to the substrate, but not to the fullerene molecules. A microscopy tip is then used to mechanically push away fullerene molecules from the substrate surface at specific locations. This allows the "self-assembling" molecules 5 to bond to the substrate in the pattern defined by the microscopy tip.

Contrary to the Examiner's characterization of the IBM Technical Disclosure Bulletin, the solution is not used to form the fullerene monolayer. Instead, the process begins with a monolayer of fullerene. Nor is the microscopy tip used to push away fullerene molecules that are not part of the monolayer. Instead, the tip is used to push away fullerene molecules from the substrate, allowing the "self-assembling" molecules to bond to the substrate. Thus, the solution used by the IBM Technical Disclosure Bulletin is not a solvent for the fullerene; instead, it is a carrier for the "self-assembling" molecules.

Bunshah is directed to a process for producing fullerenes. An electron beam is directed to a carbon target. Carbon soot is deposited on the cathode and on a chilled copper plate. The soot is collected as fullerene 60 or fullerene 70. Toluene and other solvents are the preferred solvents for carrying away the fullerene.

The rejected claims are directed to a process of forming a monolayer of fullerene on a substrate. The IBM Technical Disclosure Bulletin does not describe how to form a monolayer, as it starts with the assumption that a monolayer has already been formed. The applicants' process is directed to forming a multi-layer fullerene and removing layers leaving the approximate monolayer. One of the techniques for removing the monolayers, which is the subject of many of the rejected claims, employs a solvent, such as described by Bunshah. However, the IBM Technical Disclosure Bulletin, alone or with Bunshah, fails to teach the technique of forming a monolayer of fullerene by

removing layers from a multi-layer. Therefore, claims 1-3, 14, 15 and 17-20 are patentable over the IBM Technical Bulletin in view of Bunshah.

Claims 1-3, 14, 16 and 17 have been rejected as unpatentable over Hamza et al., claim 15 has been rejected as unpatentable over Hamza et al. in view of Bethune et al. (5,374,463).

Hamza et al. describe a process of depositing multiple layers of fullerene 60 on aluminum at a temperature of 800 K (525°C) and a pressure of 2×10^{-9} torr. Hamza further describes a programmed desorption process such that the multi-layer is desorbed to a monolayer at 500 to 570 K (225°-300°C) and that the monolayer remained at temperatures of 600 K.

Bethune teaches depositing a multi-layer of fullerene onto a substrate wherein the substrate temperature is held to 150°C. Bethune does not teach forming a monolayer. Applicants' claims are directed to the technique of forming a monolayer of fullerene on a substrate wherein the temperature of the substrate is not greater than 200°C. Applicants accomplish this through a beam generator to break the fullerene-to-fullerene molecular bond (claims 4 et seq.) or using a solvent (claims 18 et seq.). This distinguishes from both Hamza and Bethune. Bethune does not achieve a monolayer, and Hamza cannot deposit the fullerene by sublimation at below about 800K (525°C). Indeed, a sublimation process requires elevated temperatures, above those recited in Applicants' claims. Accordingly, claims 1-3 and 14-17 are clearly patentable over Hamza et al., alone or in combination with Bethune et al.

In view of the foregoing, it is believed that the present application is in condition for allowance, and that action is respectfully solicited.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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MARKED-UP VERSION OF REPLACEMENT PARAGRAPHS

Please amend the paragraph at page 1, lines 5-12 to read as follows:

This application claims priority of U.S. Provisional Patent Application No. 60/208,873 filed on June 1, 2000, of U.S. Provisional Patent Application No. 60/208,760 filed June 2, 2000, and of U.S. Provisional Patent Application No. 60/232,790 filed September 15, 2000. This application is related to U.S. Application No. 09/835,120 filed April 13, 2001 by John W. Dykes, Joel W. Hoehn, James E. Angelo and William D. Mosley for "Ultrathin Protective Overcoats for Magnetic Materials", the disclosure of which is incorporated herein by reference. This application is also related to U.S. Application No. 09/871,007 filed May 31, 2001 by John W. Dykes, Joel W. Hoehn, James E. Angelo and William D. Mosley for "Process for Production of Ultrathin Protective Overcoats", now U.S. Patent No. 6,479,111 granted November 12, 2002.

MARKED-UP VERSION OF REPLACEMENT CLAIMS

1. (Amended) A process of forming a coating on a substrate, the process comprising steps of:

a) forming a coating on the substrate comprising a plurality of layers of fullerene molecules; and

~~a~~b) removing layers of ~~a multilayer~~the fullerene ~~coating~~ molecules, while maintaining a temperature of the substrate at no more than about 200 degrees C, leaving an approximate monolayer coating of fullerene molecules on the substrate~~, wherein the fullerene is removed while the temperature of the substrate remains no more than about 200 degrees~~ C.

2. (Amended) The process of claim 1, wherein the temperature of the substrate is maintained ~~at a temperature~~ no more than about 150°C during the removal of layers of fullerene molecules from th~~a multilayer fullerene~~ coating.

3. (Amended) The process of claim 1, wherein the temperature of the substrate is maintained ~~at a temperature~~ no more than about 100°C during the removal of layers of fullerene molecules from th~~a multilayer fullerene~~ coating.

4. (Amended) The process of claim 1, wherein ~~removing of fullerene from a multilayer fullerene coating~~step (b) includes:

b~~a~~1) adjusting a beam generator to produce a beam arranged to break the fullerene-to-fullerene intermolecular bond of the ~~multilayer~~ coating and inadequate to break the fullerene-to-substrate association/bond of the coating, and

ba2) directing the beam at the ~~multilayer~~ coating to break the fullerene-to-fullerene intermolecular bond.

Claims 5-7 are unchanged.

8. (Amended) The process of claim ~~4~~7, wherein the laser beam generator produced a laser frequency below the ultraviolet frequency range.

Claim 9 is unchanged.

10. (Amended) The process of claim 4, wherein step (ab2) includes:

directing the beam at an acute angle to the substrate.

Claim 11 is unchanged.

12. (Amended) The process of claim 4, wherein step (ab2) further includes steps of:

i) focusing the beam so that the beam impinges less than all of the coating ~~at a relatively small area of the substrate~~, and

ii~~i~~) moving the beam generator relative to the substrate so that the beam successively impinges substantially the entire ~~exposed multilayer~~ coating.

13. (Amended) The process of claim 4, wherein step (ab2) includes

i) focusing the beam so that the beam impinges less than all of the coating ~~at a relatively small area of the substrate~~, and

ii) moving the beam generator relative to the substrate so that the beam successively impinges selected portions of the ~~multilayer~~ coating.

Claims 14-17 are unchanged.

18. (Amended) The process of claim 1, wherein ~~removing fullerene from the multilayer fullerene coating~~step (b) includes steps of:

~~a~~b1) applying a ~~fullerene~~ solvent to the ~~multilayer~~ coating for a period of time adequate to break the fullerene-to-fullerene intermolecular bond of the ~~multilayer~~ coating and inadequate to break the fullerene-to-substrate association/bond of the coating to thereby ~~dissolve~~ remove the fullerene molecules from~~in~~ the coating that ~~is~~ are not bonded to the substrate, and

~~a~~b2) removing the solvent.

19. (Amended) The process of claim 18, wherein the temperature of the substrate is~~applying the solvent to the multilayer fullerene coating is performed at a temperature~~ not greater than 150°C during application of the solvent.

Claim 20 is unchanged.